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ABSTRACT

In an effort to increase curriculum opportunities in a rural school district, a computer project was implemented involving grade 9-12 students chosen on the basis of national percentile scores, IQ, and desire to attend college. The project offered, through programmed computer instruction, physics, French I and II, and German I. One proctor was hired to administer the program. Each student was presented with a program to complete for credit (only 2 of the 18 credits required for graduation could be acquired through a computer course). During the summer of 1982 extensive study was done to determine the type and size of microcomputers to be used. It was found that much of the software needed to implement the program could be used only on certain types of computers. Thus, availability of software determined purchase of the six computers (three Comodore Pets, two TRS-80s, and one Apple II--all 48K). Due to the type of program implemented, statistical analysis on the success can be measured only by its continuance. This program will continue to operate in the school in which it was implemented and and will be expanded to another school in the county for the 1983-84 school year. The program budget, equipment, and a list of all software purchased (or developed by the proctor) are provided. (AH)

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# USE OF COMPUTER INSTRUCTION IN RURAL SCHOOLS TO INCREASE CURRICULUM OPPORTUNITIES FOR THE COLLEGE BOUND STUDENT

ESEA Title IV-C
Project Report

Ronnie J. Ware

Choctaw County School District
Ackerman, Mississippi 39735

July 1983

RC014188

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A. Choctaw County School District
Ty A. Cobb, Superintendent
P. O. Drawer 398
Project Year 1982-83
Funded by ESEA Title IV-C

The Choctaw County School District implemented a computer project at Ackerman High School which involved grades 9-12. This group was selected based on national percentile scores, IQ, and desire to attend college.

The project offered, through programmed computer instruction, Physics, French I and II, and German I. One proctor with a liberal arts degree, with background in science, math and foreign languages was hired. Each student was presented with a program to complete for credit. The courses offered were qualified as electives to the present curriculum. Choctaw County requires 18 credits for graduation and courses taken by computer can account for 2 credits toward graduation.

B. Needs

Because of the limited instructional areas that are offered in the instructional program of rural schools, often, the student fails to pursue those areas of study he enjoys due to the lack of sufficient background before entering college. Through this project we were able to establish and implement a program to meet these needs of students. Without this approach the system would not have been able to hire teachers to offer these areas of instruction.

C. Objectives

The district proposed to develop and adapt an instructional program based on computer programmed instruction. This program was to be offered to increase the curriculum opportunities in which students could participate.

The district proposed to develop this program to supplement the now existing curriculum. This program was adopted at Ackerman for 1983-84 school year and has been expanded to Weir High School for the 1983-84 school year.

The project proposed to provide one proctor. This proctor will be used again for the 1983-84 school year at both Ackerman and Weir High School.

The project also proposed to provide inservice training and to develop a sound research design. The evaluation design will be ongoing.

The only segment of the project not offered was Calculus. This was due to students not having a substantial math background. Though this segment will be offered during the 1984-85 school year as advanced math.

D. Activities and Procedures

The Choctaw County School System was approved to begin a Title IV-C project in the spring of 1982. But, due to the limited time to begin the project it was felt that it should begin in the fall of 1982.

During the summer of 1982 extensive study was done to determine the type and size of microcomputers to be used. It was found that much of the software needed to implement the program could be used on only certain type of computers. Thus it was required that we purchase computers based upon the availability of software. The system purchased 3 Commodore Pet, 2 TRS-80 and 1 Apple II computer. All machines were 48K.

During this time applications were taken for the Proctor position. The system hired Frances Coleman who had a PhD to serve as proctor. She had a background in math, science and foreign language and had extensive work and study abroad.

Physics, French I and II, and German were taught during a five-period day. Classes were mixed in that students were scheduled for their convenience without regard to the mixture in the computer classroom at any given time. Students were expected to work on their assignments for their subject during the class period. Since students tend to learn from each other, they were allowed to discuss the assignments. Commercial materials available with which to work included the computers, audio language tapes and filmstrips.

Physics

In physics we had available more computer and audio-visual material than in the languages. The activities of the physics students included working through tutorial and drill programs on the computers, looking at filmstrips which were chosen to illustrate concepts that they were studying, and working assigned problems with which they might need help. They had one to three tests per chapter in the book, and had a "big" test after approximately every two chapters. All test were computer-generated from the T.E.S.T. program into which the proctor had put banks of questions. The students were also required to perform and write up experiments. During this time Dr. Gordon Jones, Physics professor at MSU, visited and answered questions from the students.

French I

There were only two computer programs available to these students: a vocabulary drill and test program and a test and drill program on grammar using the T.E.S.T. program. The vocabulary program written by the proctor was the most widely used by the students. It was available for both the Pet and TRS-80, and presently being completed to be used on the Apple. The vocabulary for each lesson was listed separately. Using a given lesson's vocabulary, the student could drill and test themselves on the computers from French

to English or from English to French. The book used provided a large vocabulary. The other program which was used was drill or test on a test bank of questions on grammar from each chapter.

Other activities included the proctor reading the vocabularies of new lessons while the students repeated them; reading and translating from the lessons; conversations in French; having students listen to tapes from the lessons; and two visits during the year from Dr. Kitty Robbins, Professor of French at MSU, who introduced the students to some French music and showed slides of Paris.

French II

Students in French II came from students who had taken French I in each of the two preceding years. Since they were all at different stages of learning, it was decided to start them all at the first of the French I book.

The activities of the French II students were in general the same as those of the French I students except during their study of the first half of the French I book, they proceeded at their own pace and took computer-generated tests.

German I

These students had available for the computers the vocabulary program and the grammar drill and test program mentioned for French students; but they also had two commercial grammar programs.

In addition to the audio tapes which went with the textbook, these students also had cultural audio tapes loaned by Dr. Ben Blaney, Professor of German at MSU, and tapes of the pronunciation of each vocabulary by Dr. Blaney. He also visited the class about once a month with programs on culture, sights and customs.

How It Was Taught

In each course it was decided that that course would have to be set-up to follow a text book. Even in physics, which has more computer software available then do the languages, the software does not have the continuity necessary for a complete course. At best, the computer material, like the audio-visual material, serves to amplify and clarify the material offered in more complete and coherent courses; so the students need a book to hold and to read.

Another decision made for all the courses was that an attempt would be made to complete each book. In physics, for example, it was decided that at the high school level it was more important for each student to make a comprehensive survey of physics, becoming acquainted with concepts and vocabulary as well as learning to work relatively simple problems, than to go into great depth and rigorous mathematical treatment of only a few parts of the study of physics. In the languages, after some consultation with college teachers, it was decided to try to finish the book so that, the students would at least be acquainted with the gramatical concepts expected of them when they enter college language courses.

Since the students were to work on their own, and the classes were a mix of several courses in a classroom, this was no effort to make journal lectures. The proctor was there to help and on occasion had to make lectures where problems arose.

Changes to occur next year will be to work out for each course a schedule of lectures, also, objectives for each chapter will be given to students at the start of each chapter rather than all together at the beginning of a semester.

Physics

Starting with the textbook a list of filmstrips, each computer program and each piece of extra reading were provided. All of this material was listed, along with the problems to be done for the chapter, on a form which showed how much the student needed to do for a "C", "B", or "A" for the course. A copy of this form is included. The student kept one copy of this form and the proctor the other. The student told the proctor which grade they were trying to earn. As the student finished the work on his form, he marked it off on both copies. Each student was also given a list of the objectives for each chapter showing item which objectives would be covered on each test. When the student was prepared he took the required test. If he did not make the grade he felt he should make then he could take another test from the same test bank. Since the tests were in the computer, they could have another test within seconds. Also, the proctor kept a calendar to show by which date they should finish each chapter in order to finish the book.

A problem did exist which involved experiments. The students did well on those done from scratch, but did not enjoy those on the computer. Next year we will do only a few ourselves, and the proctor will perform or have video tapes of some demonstrations.

French I

At the beginning of each semester in French I, the student was given a list of the objectives, by Chapter, to be covered that semester. Two major tests were given for each chapter, one grammar and one vocabulary. All grammar test were not on computers. The vocabulary tests consisted of twenty random words, ten from English to French and ten from French to English, which were computer generated. A notebook was required of each student from the exercises in the book. Assignments were placed on the bulletin board and, in keeping with the philosophy that the student in this course was learning on his own, the ultimate responsibility for knowing the homework rested with the student.

As each chapter was started the proctor pronounced the vocabulary for the students, they were then encouraged to listen to the whole tape on that chapter. Next year these session will be broken down to short listening sessions.

French II

French II was very much like French I.

German I

This was basically like French I except that the students were allowed more freedom to set their own pace as long as they finished a chapter about every two weeks. Since the proctor did not feel as comfortable in German as in French, she used the vocabulary tapes made by Dr. Blaney in pronouncing the words for the students.

Instructional Material

Physics

Physics: Principles and Problems by James T. Murphy and Robert C. Smoot, Merrill Publishing Company, 1977. This book was chosen because of its simplicity. It has many problems to work, but does not go into the rigorous mathematics of some of the books. It presents concepts in simple and interesting form.

There was some material not fully covered in this book. These areas included angular velocity, acceleration and momentum; friction; sound; simple machines and electronics.

French I and II

French Today I & II by Simone Oudot and Raymond Hunt, Houghton Mifflin 1982. These were selected because of the good audio tapes, are continous in scope, list objectives for each chapter in the teachers edition, have clear explanations, and are very careful to use only words and grammatical structure which have already been presented.

German I

German Today I, Jock Moeller, Houghton Mifflin Company. This book is similar to the French I and was chosen for the same reasons.

Audio-Visual Materials

There is a list included of filmstrips and sound filmstrips. Also, a list of all materials were used in the program.

Accomplishments

Students in physics were taken to the physics competition at MSU where one won an honorable mention, and the average of the whole class was two points above the average of all the students in the competition. The language students were taken to the Foreign Language Fair at JSU where six students won first or second place in six different competitions.

E. Due to the type of program that we implemented, as stated in the project, we found that it would be hard to do a statistical analysis on the success of the program. The success of the program is measured by its continuance. The program will continue to operate in the school it was implemented and will be expanded to another school in the county for the 1983-84 school year.

Instructor

The person hired to act as proctor for the project was Frances Coleman, who holds a Ph.D. in Biophysics. We were fortunate in that she lived in our county and had the expertise to run the program. Dr. Coleman has an educational background in science, math, and the languages. Having spent time abroad in her studies, she had a broad background with the languages.

Dr. Coleman also had worked with grogramming and was able to write several programs for the project. At the present time she is writing programs to be used for the 1983-84 school year.

F. See Attached for Budget Summary.

Equipment Purchased

| | |
|---|---|
| 3 - Commodore Pets | 48K |
| 2 - TRS-80 Model III | 48K |
| 1 - Apple | 48K |

We found that in the equipment line of micro computers that more software was available for the Apple & TRS-80. Due to this, we will purchase additional Apple & TRS-80 machines to be used in the other schools.

A list of all software purchased and those developed by Dr. Coleman are included.

PART C, EDUCATIONAL INNOVATION

FISCAL DATA

A. Proposed Budget Summary

Enter the estimated amounts in the appropriate spaces

BUDGET SUMMARY

| Line | Functional Categories | Account Number Function | Code | Amount Budgeted |
|---|---|---|---|---|
| 1 | INDIRECT COST | XXXXX | XXXXX | |
| 2 | SALARIES | 1000 | 100 | $13,875.00 |
| 3 | Professional | | 111 | |
| 4 | Clerical | | 112 | |
| 5 | Aides | | 113 | |
| 6 | In-service or Overtime | | 130 | |
| 7 | EMPLOYEE BENEFITS | 2500 | 200 | |
| 8 | Social Security | | 210 | 930.00 |
| 9 | Retirement | | 220 | 1214.00 |
| 10 | Unemployment Insurance | | 250 | 120.00 |
| 11 | PURCHASED SERVICES | 2000 | 300 | |
| 12 | Consultants | | 312 | |
| 13 | Data Processing | | 316 | |
| 14 | Utilities | | 321 | |
| 15 | Pupil Transportation | | 331 | |
| 16 | Travel | | 332 | 159.00 |
| 17 | | | | |
| 18 | SUPPLIES | 2000 | 400 | |
| 19 | Supplies and Materials | | 410 | 5751.00 |
| 20 | Periodicals | | 440 | |
| 21 | | | | |
| 22 | | | | |
| 23 | CAPITAL OUTLAY | 2000 | 500 | 12,951.00 |
| 24 | Equipment | | 541 | |
| 25 | Remodeling Other ($2000 Limit) | | 590 | |
| 26 | | | | |
| 27 | | | | |
| | | | TOTALS | $35,000.00 |

COMPUTER MATERIALS:

Those materials which we bought on tape I have put on disks since it is easier and quicker for the students this way.

PHYSICS

The physics materials that we bought were generally usable and helpful although the laboratory simulations did not make good experiments. I have included a list of the computer material used, and these comments refer to that list.

#1 Physics Tutorial Study Units. These are useful to the students since they do explain as well as present problems.

#8 Redcomp Lab. These were good. "Components and Resultants" and "Inelastic Collisions" were among the most useful.

#9 The Scientific Method. This is a nice program although there is not much to it. The students like to watch the water actually boil.

#14 Pet Lab Simulations. These were good, but not to be used as experiments.

#15 Wave and Vibration Diskette and #18 Superposition. These are visual demonstrations of waves and are interesting.

#16 Average Speed and #17 Average Velocity. These are among the better programs and have a little humor which the students enjoyed.

#19 Data Analysis. These are interesting programs which will aid in handling data when we do more experiments. The programs would be even better if they printed out the graphs generated.

#21 Microphys I and #22 Microphys II. These are useful programs. They each have two parts: the first is tutorial and the second is a test using problems with randomly generated numbers. There are programs in vectors, projectiles, calorimetry, gas laws and optics which are called utility programs and which compute solutions for

data entered by the students.

FRENCH

The vocabulary drill program which I wrote seemed to be very helpful to the students in learning vocabulary. The only real drawback to the program is that I had to use symbols to indicate the various accents rather than actually have the letters with the proper accents. The students also were able to use the grammar questions from the T.E.S.T. program, but I anticipate using these even more next year because I was just writing these questions as we went and the chapter that the students needed was not always available.

GERMAN

#7 German Tapes. We used a few of these, but I did not have time to get them completely correlated with the book so that we did not get full use from them. Also, it is going to be impossible to correlate some of these programs. For example, B. "Nouns and Their Articles," involves writing the correct articles for hundreds of nouns chosen at random from a list. This might be good review for second year students, but there is no way that first year students will have studied all these nouns. It could be very discouraging.

Krell's Micro-Deutsch. This came in after school started and is not on the inventory sheet. It is a more complete program and is done in an attractive way, but I did not have time to fully correlate it with the book. I anticipate much more use from it next year.

The same vocabulary drill and test and grammar drill and test were available for the German students as for the French students.

GENERAL USE

#2 Classfile. This came on a tape for a 16K machine, and I have not been able to make it work on our machine.

#3 T.E.S.T. This has been one of the most useful programs that we bought. I have put it on a disk, and we use it for tests in every subject. It is very simple. Each test bank is only 35 questions. They can be completion, true-false, or multiple choice; but the answers can have only 20 characters or less. You can choose the number of questions—up to the number in that bank—and they are generated randomly either on the computer or printed, as you wish.

#4 Typing Tutor. This has been a favorite with the students. They say that it helps in their typing class. It does not show finger placement, but shows time, slow strokes, and number of errors.

#5 Simulated Computer. This is somewhat interesting, but we have not used it much this year. We might use it more next year in teaching computer programming.

#6 Plot. This is a good program. The students like to play with the "Guess the Rule" part.

#10 Tribbles. This game is relatively complicated, and we have not dedicated the time to it that it would take to play and enjoy it.

#11 Sentence Completion, #12 Vocabulary, and #13 Word Analogies. These are good programs, and the students will play with them even though they are not part of our program. One of the English teachers sent her best students for the week to the computer room to let them work with these programs.

#20 Newton. This game is also relatively complicated and was not often used.

COMPUTER MATERIALS INVENTORY

TRS-80

1. Physics Tutorial Study Units

   A. Dynamics
   B. Momentum
   C. Heat and Temperature

2. Classfile

   A. Classfile
   B. Class Roster

3. T.E.S.T.

   A. Test Maintenance
   B. Test and Drill

4. Typing Tutor

5. Simulated Computer

   A. Simulated Computer
   B. Computer-Doodle

6. Plot

   A. Plot a Graph
   B. Guess the Rule

7. German Tapes

   A. Conjugation of sein and haben
   B. Nouns and Their Articles
   C. Adjectives
   D. The Comparative and Superlatives of Some Common Adjectives
   E. Basic Verbs
   F. Practice on Strong and Irregular Verbs
   G. Adverbs and Conjunctions
   H. Personal Pronouns
   I. Possessive Pronouns
   J. Reflexive Pronouns
   K. Relative Pronouns
   L. Separable Prefixes with Strong Verb Parts
   M. Modal Auxiliary Verbs
   N. Separable Prefixes
   O. Dative Objects
   P. Reflexive Verbs
   Q. Prepositions
   R. Subordinating and Coordinating Conjunctions
   S. Strong and Weak Adjective Endings

8. REDCOMP Lab

   A. Inelastic Collisions
   B. Principles of Heat
   C. Temperature Solubility Lab
   D. Rotational Motion
   E. Components and Resultants
   F. Heat and Phase Changes
   G. Gauss's Law

APPLE

9. The Scientific Method

10. Tribbles

11. Sentence Completion

12. Vocabulary

13. Word Analogies

PET

14. Pet Lab Simulations

    A. Acceleration Due to Gravity
    B. Gravitational Potential Energy
    C. Momentum in Elastic Collisons
    D. Radioactivity-Half Life
    E. Millikan's Exp. I
    F. Millikan's Exp. II

15. Wave and Vibration Diskette

    A. Wave Demo
    B. Feriodic Motion
    C. Waves in a Linear Medium--Introduction
    D. Waves in a Linear Medium--Superpostion
    E. Periodic Waves: Basic Concepts
    F. Periodic Waves: Interference and Standing

16. Average Speed

17. Average Velocity

18. Superposition

19. Data Analysis

    A. Plotagraph I
    B. Plotagraph II
    C. Tickertape

20. Newton

    A. I. Newton
    B. F.G. Newton

21. Microphys I

    A. PC1. Linear Kinematics
    B. PC2. Projectile Motion
    C. PC3. Momentum and Energy
    D. PC4. Energy and the Inclined Plane
    E. PC5. Inelastic Collisions
    F. PC6. Centripetal Force Analysis
    G. PC7. Pulley Systems
    H. PC8. Calorimetry
    I. PC9. Specific Heat Capacity
    J. PC10. Heat of Vaporization/Fusion
    K. PC301. Vector Analysis I
    L. PC302. Vector Analysis II
    M. PC305. Projectile Analysis-
    N. PC306. Calorimetry

22. Microphys II

    A. PC11. Specific Gas Laws
    B. PC12. General Gas Law
    C. PC13. Thermodynamics I

D. PC14. Thermodynamics II
E. PC15. Transverse Standing Waves
F. PC16. Longitudinal Standing Waves
G. PC17. Mirrors and Lenses
H. PC18. Refraction of Light
I. PC19. Series Circuit Analysis
J. PC20. Parallel Circuit Analysis
K. PC20A. Parallel Circuit Analysis (easier)
L. PC21. Series/Parallel Circuit Analysis
M. PC35. Electric Field Analysis
N. PC36. Photoelectric Effect
O. PC40. Total Internal Reflection
P. PC303. Gas Law Analysis - U
Q. PC304. Optics Analysis - U

AUDIO-VISUAL INVENTORY

AV1. The Atom (3 parts)

AV2. The Forces in Space

AV3. Uniform and Accelerated Motion

A. Uniform Motion
B. Accelerated Motion

AV4. The Special Theory of Relativity: A Simple Concept (2 parts)

AV5. General Relativity: A Theory of Gravity (5 parts)

AV6. The Concept that Shook Physics--Quantum Theory (2 parts)

AV7. Light: The Wave that Wasn't--Quantum Theory (4 parts)

AV8. The Atomic Bomb

AV9. Mechanics of Motion

A. Circular Motion
B. Dynamics--Bodies in Motion
C. Moments of Force and Torque
D. Accelerated Motion Problems

AV10. Mechanics

A. Simple Machines
B. Laws of Motion
C. Conservation of Momentum
D. Vectors--Directed Quantities

AV11. Wave Motion

A. The Science of Musical Instruments
B. Wave Motions--A Key to Modern Science
C. Electromagnetic Radiations
D. Waves and Pulses

AV12. Electricity and Magnetism

A. Force Fields
B. Safe and Sure with Electricity
C. How Batteries Work
D. How AC and DC Motors Work
E. Modern Theories of Magnetism
F. Electric Fields
G. Alternating Current Circuits

AV13. Electronics

A. How Color Television Works
B. The Amazing Electron Microscope
C. How Transistors Work
D. The Versatile Oscilloscope
E. Vaccuum Tubes

AV14. Heat and Temperature

A. How We Measure Heat
B. The New World of Low Temperature
C. Heat and Temperature--Molecular Energy
D. Heat and Work--Engines

AV15. Energy Transmission--Light and Sound

A. Geometrical Optics
B. Photoelectric Effects
C. Vibrations and Sound Waves
D. Photons and Electrons
E. Masers and Lasers
F. Doppler Effect

AV16. Atoms and Atomic Energy

A. Radioactivity
B. Using Atomic Energy for Electric Power
C. What's in the Atom?
D. What is a Neutron?
E. Atomic Detectives
F. Particle Accelerators
G. Radiation Detection
H. Elementary Particles and Quarks

## COMPUTER MATERIALS

### TRS-80

| | | |
|---|---|---|
| 1. | Physics Tutorial Study Units (6) | K-12 Micromedia Inc.<br>P.O. Box 17<br>Valley Cottage, N.Y. 10989<br>(914) 358-2582 |
| 2. | Classfile (1) | K-12 Micromedia |
| 3. | T.E.S.T. (1) | K-12 Micromedia |
| 4. | Typing Tutor (1) | K-12 Micromedia |
| 5. | Simulated Computer (6) | Selected Micromedia Software<br>Opportunities for Learning, Inc.<br>8950 Lurline Ave., Dept. J<br>Chatsworth, California 91311<br>(213) 341-2535 |
| 6. | Plot (6) | Scholastic Microcomputer Inst. Materials<br>Scholastic Inc.<br>904 Sylvan Avenue<br>Englewood Cliffs, New Jersey 07632 |
| 8. | Redcomp Lab. (6) | K-12 Micromedia |

### APPLE

| | | |
|---|---|---|
| 9. | The Scientific Method | K-12 Micromedia |
| 10. | Tribbles | K-12 Micromedia |
| 11. | Sentence Completion | K-12 Micromedia |
| 12. | Vocabulary | K-12 Micromedia |
| 13. | Word Analogies | K-12 Micromedia |

### PET

| | | |
|---|---|---|
| 14. | Pet Lab Simulations (12) | Pasco Scientific<br>1933 Republic Avenue<br>San Leandro, California 94577 |
| 15. | Wave Vibration Diskette (11) | Pasco Scientific |
| 16. | Average Speed (12) | Pasco Scientific |
| 17. | Average Velocity (12) | Pasco Scientific |

| | | |
|---|---|---|
| 18. | Superposition (11) | Pasco Scientific |
| 19. | Data Analysis (12) | Pasco Scientific |
| 20. | Newton (13) | K-12 Micromedia |
| 21. | Microphys I (13) | Microphys Programs from Mississippi School Supply |
| 22. | Microphys II (14) | Mississippi School Supply |

AUDIO-VISUAL

Science Software Systems, Inc.
11809 West Pico Boulevard
West Los Angeles, CA 90064

**Experiments:**

1. Project #3 of Chapter 2. Plot and write up using Plotagraph II.
2. PET--Acceleration due to Gravity
3. Project #1 or #2 of Chapter 8
4. Project #1 of Chapter 10
5. PET--Gravitational Potential Energy
6. PET--Linear Airtrack in Elastic Collisions
7. PET--Millikan I and II
8. PET--Radioactive Half-Life

**Projects:**

1. Project #2 of Chapter 4
2. Project #1 of Chapter 5
3. Chapter 3: Show the derivation of:

| | from: |
|---|---|
| $s=v_i t + \frac{1}{2} at^2$ | $\bar{v}=s/t$ |
| $v_f=at$ | $\bar{a}=\Delta v/t$ |
| $s=v_f t/2$ | $v=(v_0+v_f)/2$ |
| $s=\frac{1}{2}at^2$ | |
| $v_f^2=2as$ | |

4. #3 and #4 of Chapter 6
5. Derive $a=v^2/r$
6. #2 and #5 of Chapter 19
7. #1, #3, and #4 of Chapter 25

**Procedure:**

Read the assignment paying particular attention to the study questions and/or guide handed out for each chapter.
Read extra reading in class from books available there.
View and study in class any AV-material available.
Work through experiments in class and turn in experiments written up by the procedure to be given.
Work through study tests until you can make (out of 10): 100 for A
90 for B
80 for C
Turn in homework (including problems and questions, projects, and experiment write ups) at the end of the chapter and before going to the next chapter. Use loose-leaf notebook paper, not paper torn out of notebook.

**Research Paper:**

A research paper is due from all students. The following is required:
C--at least 2 pages and 2 references
A or B--4 to 6 pages and at least 5 references
The following schedule is to be followed:
January 7--topic due
February 4--list of references due
February 18--outline and at least one notecard from each reference due
March 11--paper due

| DATES | CHAPTER | EXTRA READING | | AV-MATERIAL | | | COMPUTER MATERIAL | | | EXPERIMENTS | | | PROBLEMS & QUESTIONS | | | TESTS | | | CHAPTER TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C | B | A | C | B | A | C | B | A | C | B | A | C | B | A | C | B | A | |
| 1 | 1 | Mod. Phys. pg.653:8,9, 12,13,14 | Mod. Phys. 5 Concepts pg. 19:App Calcu. | | | | | | | | | | | 1,5,9,13,17 21,25,29,33 R:1,5,9 Q:2 | 3,7,11,15, 19,23,27, 31 Q:3 | R:3,7 11 | 1,2, 5 3,4 | | | |
| 1 | 2 | Mod. Phys. pg. 39:Th. Prob. Thru pg.671: Fund.&Der. Units | | | | | | 9 19A & B | 10? | | E1 | | | 1,5,9 R:1,5,9,13 Q:1,2,7,8,9 10 | 3,7,11 | R:3,7 11 | 1,2 | | | 1 |
| 1 | 4 | | | | 3A, | | | 19C | | | P1 | | | 1,5 R:1,5,9, 13 Q;1,2,3,4 | 3,7 Q:5,6 | R:3, 11 | 1,2 | | | 1 |
| 2 | 5 | | | | 10D | | | 8E,21L, 21K(T) | | | P2 | | | 1,5,9,13,17, 21,25 R:1,5, 9,13 Q:1,5, 6,7,8 | 3,7,11,15, 19,23,27 | R:3,7 11 | 1,2 | | | 1 |
| 2 | 3 | Mod. Phys. pg. 43-50: 3.1-3.4 | | | 3A,3B 10B,9D | | | 16(T) 17(T) 21A(T) | | | | E2 | P3 | 1,5,9,13,17, 21,25,29,33, 37,41 R:1,5, 9,13,17 | 3,7,11,15, 19,23,27, 31,35,39 Q:3 | R:3,7 11,15 | 1,2, 3 | | | 1 |
| 1½ | | | | | 9B(omit 28-36) | 2 | | 20A&B | | | P4 | E6 | | 1,5,9,13,17, 21 R:1,5,9, 13 Q:1,2,3, 7,8,10 | 3,7,11,15, 19 | R:3,7 11 | 1,2 | | | |
| 1½ | 7 | | | | 10C | | | 1B,8A | | | | | | 1,5,9,13,17, 21 R:1,5 Q:1,3,5,6 | 3,7,11,15, 19 | R:3,7 | 1,2 | | | 1 |

| DATES | CHAPTER | EXTRA READING | | | AV-MATERIAL | | | COMPUTER MATERIAL | | | EXPERIMENTS | | | PROBLEMS & QUESTIONS | | | TESTS | | | CHAPTER TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C | B | A | C | B | A | C | B | A | C | B | A | C | B | A | C | B | A | |
| 1½ | 8 | Concepts pg. 136-148 | | | 9B (28-36) 9A(-26) | 9A(27) | | 21B(T), 21M, 21F(T) | | | E3 | P5 | | 1,5,9,13,17, 21 R:1,5,9, 13 Q:1,2,3,6 | 3,7,11,15, 19,23 | R:3,7 11 | 1,2 | 1 | 3 | | |
| ½ | 9 | | | | | | | | | | | | | 1,5 R:1,5 Q:1,3,5 | 3,7 | R:3 | 1 | 1 | | 1 | |
| ½ | 10 | | | Mod. Phy. 109-13 | | 9C | | | | | E4 | | | 1,5,9,13,17 R:1,5,9 Q:3 | 3,7,11,15 19 | R:3,7 | 1 | | | ) ) ) | |
| 1 | 11 | | Concepts 86-90 | | 10A | 4,5 | | 21C,21D, 21E,21G (All T) | | | | E5&6 | | 1,5,9,13,17, 21 R:1,5,9, 13 Q:1,3,5,6 | 3,7,11,15, 19,23 | R:3,7,1,2, 11 | | | | ) ) ) ) | 1 |
| 2 | 12 | | | | 14A&B | | | 1C,1D,21 H(T),21 N,21I(T) 21J(T) 22C(T) 22D(T) 8B,8F | | | | | | 1,5,9,13,17, 21,25,29 R:1,5,9,13 Q:1,2,6,8,9 | 3,7,11,15, 19,23,27 | R3,7, 11 | 1,2, 3 | | | | |
| ½ | 13 | | | | | | 14D | | | | | | | 1,5, R:1,5,9 Q:2 | | R:3,7 | 1 | | 2, | | 1 |
| ½ | 14 | | | | 14C | | | | | | | | | 1,5 | 3 | | 1 | | | | |
| 1 | 15 | | | | | | | 22&D(T) 22A&B(T) 22P | | | | | | 1,5,9,13,R:1, 5,9 Q:1,4,6 | 3,7,11,15 Q:7 | R:3,7,1 11 | | | | | 1 |

| DATES | CHAPTER | EXTRA READING | | | AV-MATERIAL | | | COMPUTER MATERIAL | | | EXPERIMENTS | | | PROBLEMS & QUESTIONS | | | TESTS | | | CHAPTER TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C | B | A | C | B | A | C | B | A | C | B | A | C | B | A | C | B | A | |
| 2 | 16 | | Mod.Phy. 249-275 | | 11B,C 15C,F | 11A | | 15A,B, C,D,E, F,22E& F(T) | | | | | | 1,5,9,13,R 1,5,9,Q:1-4,12,27,29 | 3,7,11 Q:13-15 | R:3,7 | 1,2 3 | | | | |
| 1 | 17 | | | | 11C | | | | | | | | | 1,5,9,R:1, 5,9,13,Q: 1,3,6-9 | 3,7,11 | R:3,7, 11,15 | 1,2 | | | 1 | |
| 1 | 18 | | | | 22G&E (T) | | | | | | | | | 1,5,9,R:1, 5,9,Q"1-4 7-9 | 3,7 | R:3,7, 11 | 1,2 | | | | |
| 1 | 19 | | | | 15A | | | 22G&Q (T) | | | P6 | | | 1,5,9,13,17 21,R:1,5,9, Q:1-5,11-14 | 3,7,11 15,19,23 Q:9 | R:3,7, 11 | 1,2 | | | 1 | |
| ½ | 20 | | | | | | | | | | | | | 1,5,9,R1,5,9 Q:1-3,6,7 | 3,7 | R:3,7, 11 | 1 2 | | | | |
| ½ | 21 | | | | 15E | | | | | | | | | R:1,5,Q:1-6,8 | 3,Q:7 | | 1 | | | 1 | |
| 1 | 22 | | | | 12A,B C,F | | | 22M(T) | | | | | | 1,5,9,P:1, 5,9,Q:1,2 4-6,8,10,11, 14 | 3,7,11 | R:3,7, 11 | 1,2 | | | | |
| 1 | 23 | | | | | | | | | | | | | 1,5,9,13, 17,21,25, 29,R:1,5,9, 13,17,Q:1, 2,4,5 | 3,7,11, 15,19,23, 27 | R:3,7, 11,15, 19 | 1,2 | | | 1 | |

| DATES | CHAPTER | EXTRA READING | | | AV-MATERIAL | | | COMPUTER MATERIAL | | | EXPERIMENTS | | | PROBLEMS & QUESTIONS | | | TESTS | | | CHAPTER TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C | B | A | C | B | A | C | B | A | C | B | A | C | B | A | C | B | A | |
| 2 | 24 | | | | | | | 22I,J,<br>K,L(T) | | | | | | 1,5,9,13<br>17,R:1,5,9,<br>O:1,3,5,6,9 | 3,7,11,<br>15,19 | R:3,7,<br>11 | 1,2 | | | |
| 1 | 25 | | | | 12F | | | | | | P7 | | | 1,5,9,R:1<br>5,9,O:1,2,<br>4,5,9,10,<br>12-14 | 3,7,11 | R:3,7,<br>11 | 1,2 | | | 1 |
| 1 | 26 | | | | 12G | 12H | | | | | | | | 1,5,9,13<br>R:1,5,9,O:<br>1-3,8,13 | 3,7,11,<br>15,O:12 | R:3,7 | 1,2 | 3 | | |
| 1 | 27 | | | Mod.<br>Phy.<br>251<br>260 | | 13A,<br>B,C,<br>D,E | | | | | | E7 | | 1,5,O:1,2,<br>5,8 | 3,7,11,<br>15,19 | R:1,5,<br>9 | 1,2 | 3 | 4 | 1 |
| 1 | 28 | | | | 15B<br>D,6,7 | | | | 22I | | | | | O:1,2,4,8 | 1,5,9<br>R:1,5 | 3,7,11<br>R:3,7 | 1,2 | 3 | | |
| 1 | 29 | | | | 1,16A,<br>D | | | | | | | | | 1,5,R:1,O:<br>2-6 | 3,7,11,<br>O:7-10 | R:3,5,<br>9,13 | 1,2 | 3 | | 1 |
| 1 | 30 | | | | 16B,D<br>E,F,G<br>H,& R | | | | | | | F8 | | 1,5,9,13,<br>17,R:1,5,<br>9,O:1-3,5<br>-7,10,13,<br>14 | 3,7,11,<br>15,19 | R:3,7 | 1,2 | | | |